

CLAIMS

1. A method of evaluating the driving behavior in a vehicle, comprising:
 - determining values of a plurality of parameters of the operation of a first vehicle in a first road segment;
 - determining values of the plurality of parameters for one or more second vehicles in a second road segment having similar properties to those of the first road segment;
 - comparing the determined values of the first vehicle and the one or more second vehicles; and
- 10 providing an evaluation of the driving behavior of the first vehicle, responsive to the comparison.
2. A method according to claim 1, wherein the plurality of parameters includes at least one parameter which relates to braking or decelerating of the first vehicle before a road point requiring deceleration.
- 15 3. A method according to claim 1, wherein the plurality of parameters includes at least one parameter which relates to a time or distance before a road point requiring deceleration at which the first vehicle began to decelerate.
- 20 4. A method according to claim 1, wherein the plurality of parameters includes at least one parameter related to behavior at a road curve.
- 25 5. A method according to claim 1, comprising generating warnings to a driver of the first vehicle responsive to the evaluation.
6. A method according to claim 1, comprising calculating insurance rates for the first vehicle responsive to the evaluation.
- 30 7. A method according to claim 1, comprising providing a report to a fleet manager responsive to the evaluation.

8. A method according to claim 1, comprising providing a report to a parent of the driver responsive to the evaluation.

9. A method according to claim 1, wherein the plurality of vehicles comprise at least 10
5 second vehicles.

10. A method according to claim 1, wherein the second road segment comprises the first road segment.

10 11. A method according to claim 1, wherein the second road segment is different from the first road segment.

12. A method according to claim 1, wherein determining values of the plurality of parameters for the one or more second vehicles comprises determining at a different time from
15 the determining of the parameters for the first vehicle.

13. A method according to claim 1, wherein the one or more second vehicles comprises a plurality of vehicles.

20 14. A method according to claim 13, wherein comparing the determined values of the first vehicle and the plurality of second vehicles comprises comparing the values of the first vehicle to a statistical analysis of values of the plurality of second vehicles.

25 15. A method according to claim 13, wherein comparing the determined values of the first vehicle and the plurality of second vehicles comprises comparing in a manner which gives different weight to different ones of the second vehicles.

16. A method according to claim 15, wherein comparing the determined values of the first vehicle and the plurality of second vehicles comprises comparing in a manner which gives
30 more weight to second vehicles having a specific safety rating.

17. A method according to claim 15, wherein comparing the determined values of the first vehicle and the plurality of second vehicles comprises comparing data determined under similar weather, light or time conditions.

5 18. A method of evaluating the driving behavior in a vehicle, comprising:
receiving sensor readings on the operation of a first vehicle in a first road segment;
determining structural information on the first road segment; and
analyzing a behavior of the first vehicle responsive to the sensor readings and the
structural information, by comparing to behavior of one or more vehicles under similar
10 circumstances.

19. A method according to claim 18, comprising generating warnings to a driver of the first vehicle responsive to the analyzing.

15 20. A method according to claim 18, comprising calculating insurance rates for the first vehicle responsive to the analyzing.

21. A method according to claim 18, comprising generating a driving behavior report for a driver of the vehicle responsive to the analyzing.

20 22. A method according to claim 18, wherein receiving sensor readings comprises receiving from an accelerometer.

25 23. A method according to claim 18, wherein receiving sensor readings comprises receiving from a location sensor.

24. A method according to claim 18, wherein determining structural information comprises determining a slope of the first road segment.

30 25. A method according to claim 18, wherein determining structural information comprises determining a location of a curve or an intersection.

26. A method according to claim 18, wherein determining structural information comprises determining a parameter of a curve or an intersection.
27. A method according to claim 18, wherein comparing to behavior of one or more vehicles under similar conditions comprises comparing to acts of the first vehicle at a different time.
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28. A method according to claim 18, wherein comparing to behavior of one or more vehicles under similar conditions comprises comparing to acts of the vehicles other than the first vehicle.
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29. A method according to claim 18, wherein comparing to behavior of one or more vehicles under similar conditions comprises comparing to acts performed at different times than represented by the sensor readings.
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30. A method of aiding safe driving, comprising:
determining traffic directives or warnings applicable to a vehicle; and
providing the determined traffic directives or warnings in the vehicle.
- 20 31. A method according to claim 30, comprising determining the location of the vehicle and wherein determining the directives is performed responsive to the determined location.
- 25 32. A method according to claim 30, wherein providing the determined directives or warnings comprises providing an indication of a directive not currently visible outside the vehicle at the location.
33. A method according to claim 30, wherein determining the directives or warnings comprises determining traffic signs at the location.
- 30 34. A method according to claim 30, wherein providing the determined directives or warnings comprises providing an indication of an upcoming stop or yield sign.

35. A method according to claim 30, wherein providing the determined directives or warnings comprises providing status or timing information of traffic lights.

36. A method according to claim 30, wherein providing the determined directives or 5 warnings comprises providing a speed limit applicable to a current location of the vehicle.

37. A method according to claim 30, wherein determining the traffic directives comprises determining responsive to a time of the providing.

10 38. A method according to claim 30, comprising determining whether a driver profile of the vehicle requires the warning and wherein the providing is performed only if the driver profile was determined to warrant the providing.

15 39. A method according to claim 30, wherein providing the determined directives or warnings comprises providing only if it is determined that the vehicle is probably going to violate the directive or already violated the directive.

20 40. A method according to claim 30, wherein determining the directives or warnings comprises determining by image analysis of images acquired by a camera mounted on the vehicle.

41. A method according to claim 30, wherein determining the directives or warnings comprises determining by accessing a database which lists the locations of directives, with coordinates of a current location of the vehicle.

25 42. A method according to claim 41, wherein the database does not include sufficient information to determine the geographical layout of roads.

30 43. A method according to claim 30, wherein providing the directive or warning comprises displaying a directive or warning.

44. A method according to claim 30, wherein providing the directive or warning comprises sounding a directive or warning.

45. A method according to claim 30, wherein providing the directive or warning comprises providing a tactile stimulus.

5 46. Apparatus determining the location of a vehicle, comprising:
a location determination unit, which continuously provides coordinate readings of the vehicle; and
a processor adapted to calculate interpolated or extrapolated coordinate values responsive to the coordinate readings of the location determination unit.

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47. Apparatus according to claim 46, wherein the processor is adapted to calculate the interpolated or extrapolated values responsive to at least one dynamic vehicle parameter of the vehicle at the time of a coordinate reading from the location determination unit.

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48. Apparatus according to claim 47, wherein the at least one dynamic vehicle parameter comprises one or more of the speed acceleration and azimuth of the vehicle.

49. Apparatus according to claim 46, comprising an accelerometer, and wherein the processor uses readings from the accelerometer in calculating the coordinate values.

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50. Apparatus for determining the location of a vehicle, comprising:
a location determination unit, which provides coordinate readings of the vehicle;
a look up table including correction values for the coordinate readings responsive to dynamic vehicle parameters of the vehicle; and
a processor adapted to calculate corrected coordinate values from the coordinate readings using the look up table.

51. Apparatus according to claim 50, wherein the look up table provides correction values for vehicle speed values.

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52. Apparatus for monitoring vehicle driving, comprising:
at least one sensor adapted to determine dynamic parameters of a vehicle;

an input interface adapted to receive a weather or traffic load report of a region in which the vehicle is located; and

a processor adapted to provide an indication on the vehicle behavior responsive to the determined dynamic parameters and the received weather or traffic load report.

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53. Apparatus according to claim 52, wherein the processor is adapted to adjust a speed threshold responsive to the weather or traffic report.

10 54. Apparatus according to claim 52, wherein the weather or traffic report relates to more than a single road segment.

15 55. A method of analyzing safety distance keeping of a vehicle, comprising:
collecting information on deceleration events of the vehicle;
assigning each of the deceleration events a score indicative of a probability that the deceleration was due to not keeping sufficient distance from an adjacent vehicle; and
providing a distance keeping score to the vehicle responsive to the events and assigned scores.

20 56. A method according to claim 55, wherein collecting the information comprises collecting readings of an accelerometer on the vehicle.

25 57. A method according to claim 55, wherein assigning a score to a deceleration event comprises determining the location of the deceleration and determining a probability of deceleration at the location.

58. A method according to claim 55, wherein assigning a score to a deceleration event comprises determining a severity of the deceleration.

30 59. Apparatus for monitoring vehicle driving, comprising:
at least one sensor adapted to determine dynamic parameters of a vehicle;
a location determination unit for providing coordinates of the vehicle;
a database of locations of interest for driving analysis; and

a processor which analyzes the driving responsive to comparison of coordinates from the location determination unit with locations in the database,

wherein the database does not include sufficient data to show the geographical path of roads traversed by the vehicle.

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60. Apparatus according to claim 59, wherein the apparatus is mounted entirely on the vehicle.

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61. Apparatus according to claim 59, wherein the location determination unit comprises a GPS receiver.

62. Apparatus according to claim 59, wherein the database represents each road segment in the database by at most four coordinates.

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63. Apparatus according to claim 59, wherein the database represents curves by a single coordinate pair.

64. Apparatus according to claim 59, wherein the database represents intersections by a single coordinate pair.

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65. Apparatus according to claim 59, wherein the database indicates locations of traffic signs.

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66. Apparatus according to claim 59, wherein the database indicates locations of relatively steep slopes.

67. A method of providing a driving behavior score, comprising:

installing a monitoring unit in a vehicle, without connecting data reception ports of the monitoring unit to mechanisms of the vehicle;

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collecting dynamic vehicle parameters of the vehicle by the monitoring unit;

analyzing the vehicle driving behavior of the vehicle responsive to the collected dynamic parameters from the monitoring unit; and

assigning a score responsive to the analyzing.

68. A method according to claim 67, wherein the monitoring unit is not connected through wires to the vehicle, other than any power connection.

5 69. A method according to claim 67, wherein collecting the dynamic vehicle parameters comprises determining vehicle acceleration, speed, location and azimuth.

70. A method according to claim 67, comprising assigning an insurance rate to the vehicle responsive to the score.

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71. A method of determining parameters of road segments of interest, comprising:
receiving dynamic parameters of a plurality of vehicles together with corresponding locations;

15 determining a location at which a plurality of vehicles have similar values of the dynamic parameters; and

assigning the determined location a location-description responsive to the similar values of the dynamic parameters.

20 72. A method according to claim 71, wherein determining the location comprises determining a location at which the received dynamic parameters of some of the vehicles do not indicate the location description determined for the location.

73. A method according to claim 71, wherein assigning the location description comprises determining that the location has an intersection.

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74. A method according to claim 71, wherein assigning the location description comprises determining that the location has a traffic sign.

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75. A method according to claim 71, wherein assigning the location description comprises determining that the location has a traffic light.

76. A method according to claim 71, wherein assigning the location description comprises determining that the location has a curve.

77. A method according to claim 76, wherein assigning the location description comprises assigning at least one parameter of the curve to the location.

5 78. A method according to claim 71, wherein assigning the location description comprises determining that the location has a slope.

79. A method according to claim 74, wherein assigning the location description comprises determining that the location has a yield sign.

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80. A method of handling vehicle monitoring information, comprising:
accumulating data on the driving of a vehicle, which data identifies at least two of driving time, driving locations and driving dynamic parameters with the vehicle; and
storing the accumulated data in a memory unit, with instructions to destroy at least
15 identification information which may link the accumulated data to the vehicle, within a predetermined time.

20 81. A method according to claim 80, comprising analyzing the data to generate a general report on the driving profile of the vehicle, which report does not link the vehicle to specific driving events.

82. A method according to claim 81, wherein the accumulated data is discarded immediately after the analyzing is completed.

25 83. A method according to claim 80, wherein the accumulated data is timed to be discarded within at most twelve hours from its accumulation.

84. A method according to claim 80, wherein the vehicle owner may give an instruction to prevent the discarding of the data.

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85. A method according to claim 80, wherein the data discarding is scheduled without a mechanism for aborting the discarding.

86. A driver warning unit, comprising:
a monitoring unit that determines warnings to be provided to a driver of a vehicle; and
an output unit adapted to provide warnings determined by the monitoring unit to a driver of the vehicle, such that the warnings are not noticeable by other passengers in the
5 vehicle, sitting in a same passenger cabin as the driver.

87. A driver warning unit according to claim 86, wherein the monitoring unit determines the warnings to be provided responsive to a location of the vehicle.

10 88. A driver warning unit according to claim 86, wherein the output unit comprises a display that can only be viewed from a limited angle span.

89. A driver warning unit according to claim 86, wherein the output unit comprises a display positioned on the steering wheel.

15 90. A driver warning unit according to claim 86, wherein the output unit comprises a tactile stimulus provider.

91. A driver warning unit according to claim 86, wherein the monitoring unit determines
20 the warnings to be provided responsive to dynamic parameters of the vehicle.

92. A driver warning unit according to claim 86, wherein the monitoring unit determines the warnings to be provided without relation to dynamic parameters of the vehicle.

25 93. A method of providing warnings to a driver, comprising:
determining road conditions which may affect a vehicle;
providing a driver profile of the vehicle; and
selecting warnings to be provided to a driver of the vehicle or times at which the
warnings are to be provided, responsive to the determined road conditions and the driver
30 profile.

94. A method according to claim 93, wherein determining the road conditions comprises determining a location of the vehicle.

95. A method according to claim 93, wherein determining the road conditions comprises identifying signs applicable to the vehicle.

5 96. A method according to claim 93, wherein determining road conditions which may affect the vehicle comprises determining dynamic parameters of the vehicle.

97. A method according to claim 93, wherein determining road conditions which may affect the vehicle comprises determining a safety hazard.

10 98. A method according to claim 93, wherein determining road conditions which may affect the vehicle comprises determining without relation to dynamic parameters of the vehicle.

99. A method according to claim 93, wherein the driver profile is generated responsive to
15 analysis of previous driving of the vehicle or the driver.

100. A method according to claim 93, wherein the driver profile comprises the age of the driver.

20 101. A method according to claim 93, wherein selecting warnings to be provided to the driver comprises selecting warnings that the driver has previously not ignored.

102. A method according to claim 93, wherein selecting a time of providing the warning comprises selecting according to an expected time required by the driver to respond to the
25 warning.

103. A method according to claim 93, wherein selecting warnings to be provided to the driver comprises selecting responsive to previous experience of the driver in handling the determined road conditions.

30 104. A driving monitoring system, comprising:
at least one sensor adapted to collect data on the driving of a vehicle;

a warning generator adapted to generate driver warnings responsive to readings of the at least one sensor;

an output unit for providing warnings generated by the warning generator; and

5 a report generator adapted to analyze the driving behavior of the vehicle based on readings of the at least one sensor.

105. A system according to claim 104, wherein the report generator is included in a same processing unit with the warning generator.

10 106. A system according to claim 104, wherein the report generator is not on board the vehicle, while the warning generator is mounted on the vehicle.

107. A system according to claim 104, wherein the at least one sensor comprises a location determination sensor.

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108. A system according to claim 104, wherein the at least one sensor comprises an accelerometer.

109. A system according to claim 104, wherein the at least one sensor comprises a camera.

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110. A system according to claim 104, wherein warning generator is adapted to generate the warnings responsive to the analysis of the report generator.

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111. A system according to claim 104, wherein the report generator performs the analysis responsive to sensor readings of at least an hour.

112. A system according to claim 104, wherein the output unit displays the warnings to the driver.

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113. A system according to claim 104, wherein the output unit provides the warnings to a person remote from the vehicle.

114. A method of assigning a safety score to a vehicle, comprising:

collecting information on the driving behavior of the vehicle;
analyzing the collected information so as to determine the behavior of the vehicle with relation to at least one of relating to traffic lights, changing lanes, overtaking and tailgating; and assigning a score to the vehicle responsive to the analysis.

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115. A method according to claim 114, wherein collecting the information comprises collecting dynamic parameter values from sensors on the vehicle.

10 116. A method according to claim 114, wherein analyzing the collected information comprises determining a number of times that the vehicle passed through a yellow or red light.

117. A method according to claim 114, wherein analyzing the collected information comprises determining a number of times that the vehicle responded with a delay to a change of a traffic light to green.

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118. A method according to claim 114, comprising determining an insurance rate for the vehicle responsive to the score.

20 119. A method according to claim 118, wherein determining the insurance rate is performed additionally responsive to a physical examination of the vehicle.

120. A method of assigning a safety score to a vehicle, comprising:

25 collecting information on the driving behavior of the vehicle;
analyzing the collected information so as to determine at least one parameter of the slowing down of the vehicle toward road segments that require slowing down; and
assigning a score to the vehicle responsive to the analysis.

121. A method according to claim 120, wherein analyzing the collected information comprises determining a number of times in which the vehicle did not slow down on time.

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122. A method according to claim 120, wherein analyzing the collected information comprises determining an average distance before the road segments at which the vehicle begins to slow down.

123. A method according to claim 120, wherein the road segment that requires slowing down comprises a slope.

5 124. A method according to claim 120, wherein the road segment that requires slowing down comprises a curve.

125. A method according to claim 120, wherein the road segment that requires slowing down comprises an intersection.

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126. A method of analyzing vehicle behavior, comprising:
collecting information on the driving behavior of the vehicle;
identifying topographical attributes of roads traversed by the vehicle; and
analyzing the collected information so as to determine information on the driving behavior of the vehicle with relation to topographical road attributes.

127. A method according to claim 126, wherein the analyzing is performed responsive to a location of a steep slope.

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128. A method according to claim 126, wherein the analyzing is performed responsive to an angle of a steep slope.

129. A method of assigning a safety score to a vehicle, comprising:

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collecting information on the driving behavior of the vehicle;
determining the location of a curve;
analyzing the collected information so as to determine a plurality of parameters of the behavior of the vehicle with relation to the curve; and
assigning a score to the vehicle responsive to the analysis.

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130. A method according to claim 129, wherein the plurality of parameters include at least one of lateral deceleration in the curve, the vehicle speed on approaching the curve, frontal deceleration of the vehicle upon approaching the curve and distance or time at which the vehicle began to decelerate before the curve.